

What is claimed is:

1. An image forming apparatus comprising:

an image carrier which is structured so as to be able to carry an electrostatic latent image on a surface of said image carrier;

a toner carrier which rotates in a predetermined direction while carrying toner and accordingly transports said toner to an opposed position facing said image carrier; and

image forming means which applies a predetermined developing bias upon said toner carrier, causes said toner carried by said toner carrier move to said image carrier, visualizes said electrostatic latent image with said toner, and accordingly forms a toner image,

characterized in that said image forming means executes optimization during which a toner image is formed as a patch image and density control factors influencing an image density are optimized based on a image density of said patch image,

and that prior to formation of said patch image, idling of said toner carrier is executed which requires to rotate said toner carrier at least one round or more.

2. The image forming apparatus of claim 1, characterized in that said density control factors include said developing bias.

3. The image forming apparatus of claim 1, further comprising exposure means which exposes said surface of said image carrier with a light beam and accordingly forms said electrostatic latent image on said surface of said image carrier,

characterized in that said density control factors include an energy density of said light beam.

4. The image forming apparatus of claim 1, further comprising:

light emitting means which irradiates light toward a patch image area of said surface of said image carrier in which said patch image is formed; and

light amount detecting means which detects a light amount from said patch image area,

characterized in that said light amount detecting means detects the light amount from said patch image area as it does not carry toner and the light amount from said patch image area as it carries said patch image, and said patch image density is calculated based on the result of the detection,

and that while executing said idling, a preceding process is executed which requires to detect the light amount from said patch image area as it does not carry toner.

5. The image forming apparatus of claim 4, characterized in

that for execution of said preceding process, such a condition is set which makes at least one of said density control factors minimum.

6. The image forming apparatus of claim 5, characterized in that it is possible to change said developing bias, as said density control factor, within a predetermined variable range,

and that for execution of said preceding process, said developing bias is set to the minimum value within said variable range.

7. The image forming apparatus of claim 1, further comprising:

an intermediate member which is capable of temporarily carrying a toner image which has been formed on said surface of said image carrier;

light emitting means which irradiates light toward a patch image area of a surface of said intermediate member in which said patch image is formed; and

light amount detecting means which detects a light amount from said patch image area;

characterized in that said light amount detecting means detects the light amount from said patch image area as it does not carry toner and the light amount from said patch image area as it carries said patch image, and said patch image density is calculated based on the result of the detection,

and that while executing said idling, a preceding process is

executed which requires to detect the light amount from said patch image area as it does not carry toner.

8. The image forming apparatus of claim 7, characterized in that for execution of said preceding process, such a condition is set which makes at least one of said density control factors minimum.

9. The image forming apparatus of claim 8, characterized in that it is possible to change said developing bias, as said density control factor, within a predetermined variable range,

and that for execution of said preceding process, said developing bias is set to the minimum value within said variable range.

10. The image forming apparatus of claim 1, further comprising restricting means which abuts on a surface of said toner carrier at a restricting position which is on the upstream side to said opposed position in a rotation direction of said toner carrier, and accordingly restricts the amount of said toner carried on said surface of said toner carrier,

characterized in that with said toner carrier and said image carrier facing each other at said opposed position, said restricting position is below the center of rotations of said toner carrier.

11. The image forming apparatus of claim 10, further

comprising peeling means which abuts on said surface of said toner carrier at a peeling position which is on the upstream side to said restricting position in the rotation direction of said toner carrier, and accordingly peels off said toner adhering to said surface of said image carrier,

characterized in that with said toner carrier and said image carrier facing each other at said opposed position, said peeling position is above said restricting position.

12. The image forming apparatus of claim 1, characterized in that a surface of said toner carrier is conductive.

13. The image forming apparatus of claim 1, characterized in that said toner image is formed using said toner which contains a wax component which serves as a parting agent for prevention of fixing offset.

14. An image forming method in which an electrostatic latent image is formed on a surface of an image carrier and a predetermined developing bias is applied upon a toner carrier which rotates while carrying toner on a surface of said toner carrier, to thereby move said toner carried by said toner carrier to said image carrier and visualize said electrostatic latent image as a toner image,

characterized in that optimization is executed which requires to form a toner image as a patch image and to optimize density control

factors influencing an image density based on a patch image density of said patch image to control an image density,

and that prior to formation of said patch image, idling of said toner carrier is executed which requires to rotate said toner carrier at least one round or more.

15. An image forming apparatus comprising:

an image carrier which is structured so as to be able to carry an electrostatic latent image on a surface of said image carrier;

a toner carrier which rotates in a predetermined direction while carrying toner and accordingly transports said toner to an opposed position facing said image carrier; and

image forming means which applies a predetermined developing bias upon said toner carrier, causes said toner carried by said toner carrier move to said image carrier, visualizes said electrostatic latent image with said toner, and accordingly forms a toner image,

characterized in that it is possible to selectively execute an image forming operation, which requires to form a toner image corresponding to an image formation request upon receipt of said image formation request by a user, and optimization which requires to form a toner image as a patch image, to detect a density of said patch image and to optimize a density control factor influencing an image density based on the result of the detection to control an image density,

and that in the event that there is not said image formation request newly received after an elapsed time since the end of formation of a toner image by said image forming means has reached a first predetermined period, said optimization is executed.

16. The image forming apparatus of claim 15, characterized in that in the event that there is said image formation request newly received when said elapsed time is shorter than said first predetermined period but is equal to or longer than a second predetermined period which is shorter than said first predetermined period, said image forming operation in response to said image formation request is executed after executing said optimization.

17. The image forming apparatus of claim 15, characterized in that said toner carrier is rotated at least one round or more before formation of said patch image.

18. The image forming apparatus of claim 15, further comprising charging means which charges said surface of said image carrier to a predetermined surface potential prior to formation of said electrostatic latent image,

characterized in that said elapsed time is calculated since termination of charge of said image carrier by said charging means.

19. The image forming apparatus of claim 15, further comprising restricting means which abuts on a surface of said toner carrier at a restricting position which is on the upstream side to said opposed position in a rotation direction of said toner carrier, and accordingly restricts the amount of said toner carried on said surface of said toner carrier,

characterized in that with said toner carrier and said image carrier facing each other at said opposed position, said restricting position is below the center of rotations of said toner carrier.

20. The image forming apparatus of claim 20, further comprising peeling means which abuts on said surface of said toner carrier at a peeling position which is on the upstream side to said restricting position in the rotation direction of said toner carrier, and accordingly peels off said toner adhering to said surface of said image carrier,

characterized in that with said toner carrier and said image carrier facing each other at said opposed position, said peeling position is above said restricting position.

21. The image forming apparatus of claim 15, characterized in that a surface of said toner carrier is conductive.



22. The image forming apparatus of claim 15, characterized in that said toner image is formed using said toner which contains a wax component which serves as a parting agent for prevention of fixing offset.

23. An image forming method in which an electrostatic latent image is formed on a surface of an image carrier in response to an image formation request from a user and a predetermined developing bias is applied upon a toner carrier which rotates while carrying toner on a surface of said toner carrier, to thereby move said toner carried by said toner carrier to said image carrier, to visualize said electrostatic latent image with toner and to form a toner image,

characterized in that in the event that there is not said image formation request newly received after an elapsed time since the end of formation of a toner image by said image forming means has reached a first predetermined period, optimization is executed which requires to form a toner image as a patch image, to detect a density of said patch image and to optimize a density control factor influencing an image density based on the result of the detection to control an image density.

24. An image forming apparatus comprising:  
an image carrier which is structured so as to be able to carry an electrostatic latent image on a surface of said image carrier;  
a toner carrier which rotates in a predetermined direction while

carrying toner and accordingly transports said toner to an opposed position facing said image carrier; and

image forming means which applies a predetermined developing bias upon said toner carrier, causes said toner carried by said toner carrier move to said image carrier, visualizes said electrostatic latent image with said toner, and accordingly forms a toner image,

characterized in that it is possible to execute an image forming operation which requires to form a toner image corresponding to an image formation request upon receipt of said image formation request by a user,

and that in the event that said image formation request is received when an elapsed time since the end of formation of a toner image by said image forming means is equal to or longer than a third predetermined period, before executing said image forming operation in response to said image formation request, optimization is executed which requires to form a toner image as a patch image after rotating said toner carrier at least one round or more, to detect a density of said patch image and to optimize a density control factor influencing an image density based on the result of the detection to control an image density.

25. The image forming apparatus of claim 24, further comprising restricting means which abuts on a surface of said toner carrier at a restricting position which is on the upstream side to said opposed position in a rotation direction of said toner carrier, and accordingly

restricts the amount of said toner carried on said surface of said toner carrier,

characterized in that with said toner carrier and said image carrier facing each other at said opposed position, said restricting position is below the center of rotations of said toner carrier.

26. The image forming apparatus of claim 25, further comprising peeling means which abuts on said surface of said toner carrier at a peeling position which is on the upstream side to said restricting position in the rotation direction of said toner carrier, and accordingly peels off said toner adhering to said surface of said image carrier,

characterized in that with said toner carrier and said image carrier facing each other at said opposed position, said peeling position is above said restricting position.

27. The image forming apparatus of claim 24, characterized in that a surface of said toner carrier is conductive.

28. The image forming apparatus of claim 24, characterized in that said toner image is formed using said toner which contains a wax component which serves as a parting agent for prevention of fixing offset.

29. An image forming method in which an electrostatic latent

image is formed on a surface of an image carrier in response to an image formation request from a user and a predetermined developing bias is applied upon a toner carrier which rotates while carrying toner on a surface of said toner carrier, to thereby move said toner carried by said toner carrier to said image carrier, to visualize said electrostatic latent image with toner and to form a toner image,

characterized in that in the event that there is said image formation request newly received when an elapsed time since the end of formation of a toner image is equal to or longer than a third predetermined period, before forming a toner image in response to said image formation request, optimization is executed which requires to form a toner image as a patch image after rotating said toner carrier at least one round or more, to detect a density of said patch image and to optimize a density control factor influencing an image density based on the result of the detection to control an image density.

30. An image forming apparatus comprising:

an image carrier which is structured so as to be able to carry an electrostatic latent image on a surface of said image carrier;

a toner carrier which rotates in a predetermined direction while carrying toner and accordingly transports said toner to an opposed position facing said image carrier; and

image forming means which applies a predetermined developing

bias upon said toner carrier, causes said toner carried by said toner carrier move to said image carrier, visualizes said electrostatic latent image with said toner, and accordingly forms a toner image,

characterized in that in the event that there is not said image formation request newly received after an elapsed time since the end of formation of a toner image has reached a fourth predetermined period, idling of said toner carrier is executed which requires to rotate said toner carrier at least one round or more.

31. The image forming apparatus of claim 30, characterized in that in the event that there is not said image formation request newly received even after said fourth predetermined period from the end of said idling, said idling is executed once again.

32. The image forming apparatus of claim 30, characterized in that when said elapsed time reaches a fifth predetermined period which is longer than said fourth predetermined time, said idling is executed, a toner image is formed as a patch image, a density of said patch image is detected, and a density control factor influencing an image density is optimized based on the result of the detection.

33. The image forming apparatus of claim 30, further comprising restricting means which abuts on a surface of said toner carrier

at a restricting position which is on the upstream side to said opposed position in a rotation direction of said toner carrier, and accordingly restricts the amount of said toner carried on said surface of said toner carrier,

characterized in that with said toner carrier and said image carrier facing each other at said opposed position, said restricting position is below the center of rotations of said toner carrier.

34. The image forming apparatus of claim 33, further comprising peeling means which abuts on said surface of said toner carrier at a peeling position which is on the upstream side to said restricting position in the rotation direction of said toner carrier, and accordingly peels off said toner adhering to said surface of said image carrier,

characterized in that with said toner carrier and said image carrier facing each other at said opposed position, said peeling position is above said restricting position.

35. The image forming apparatus of claim 30, characterized in that a surface of said toner carrier is conductive.

36. The image forming apparatus of claim 30, characterized in that said toner image is formed using said toner which contains a wax component which serves as a parting agent for prevention of fixing offset.

37. An image forming apparatus comprising:

an image carrier which is structured so as to be able to carry an electrostatic latent image on a surface of said image carrier;

a toner carrier which rotates in a predetermined direction while carrying toner and accordingly transports said toner to an opposed position facing said image carrier; and

image forming means which applies a predetermined developing bias upon said toner carrier, causes said toner carried by said toner carrier move to said image carrier, visualizes said electrostatic latent image with said toner, and accordingly forms a toner image,

characterized in that it is possible to execute an image forming operation which requires to form a toner image corresponding to an image formation request upon receipt of said image formation request by a user,

and that in the event that there is said image formation request newly received when an elapsed time since the end of formation of a toner image is equal to or longer than a sixth predetermined period, before executing said image forming operation in response to said image formation request, idling of said toner carrier is executed which requires to rotate said toner carrier at least one round or more.

38. The image forming apparatus of claim 37, characterized in that in the event that there is said image formation request newly received

when said elapsed time is equal to or longer than a seventh predetermined period which is longer than said sixth predetermined period, before forming a toner image in response to said image formation request, said idling is executed and optimization is then executed which requires to form a toner image as a patch image, to detect a density of said patch image and to optimize a density control factor influencing an image density based on the result of the detection.

39. The image forming apparatus of claim 37, further comprising restricting means which abuts on a surface of said toner carrier at a restricting position which is on the upstream side to said opposed position in a rotation direction of said toner carrier, and accordingly restricts the amount of said toner carried on said surface of said toner carrier,

characterized in that with said toner carrier and said image carrier facing each other at said opposed position, said restricting position is below the center of rotations of said toner carrier.

40. The image forming apparatus of claim 39, further comprising peeling means which abuts on said surface of said toner carrier at a peeling position which is on the upstream side to said restricting position in the rotation direction of said toner carrier, and accordingly peels off said toner adhering to said surface of said image carrier,



characterized in that with said toner carrier and said image carrier facing each other at said opposed position, said peeling position is above said restricting position.

41. The image forming apparatus of claim 37, characterized in that a surface of said toner carrier is conductive.

42. The image forming apparatus of claim 37, characterized in that said toner image is formed using said toner which contains a wax component which serves as a parting agent for prevention of fixing offset.

43. An image forming method in which an electrostatic latent image is formed on a surface of an image carrier and a predetermined developing bias is applied upon a toner carrier which rotates in a predetermined direction while carrying toner on a surface of said toner carrier, to thereby move said toner carried by said toner carrier to said image carrier, to visualize said electrostatic latent image with toner and to form a toner image,

characterized in that in the event that there is not said image formation request newly received after an elapsed time since the end of formation of a toner image has reached a fourth predetermined period, idling of said toner carrier is executed which requires to rotate said toner carrier at least one round or more.

44. The image forming method of claim 43, characterized in that in the event that there is not said image formation request newly received even after said fourth predetermined period from the end of said idling, said idling is executed once again.

45. The image forming method of claim 43, characterized in that when said elapsed time reaches a fifth predetermined period which is longer than said fourth predetermined time, said idling is executed, a toner image is formed as a patch image, a density of said patch image is detected, and a density control factor influencing an image density is optimized based on the result of the detection.

46. An image forming method in which an electrostatic latent image is formed on a surface of an image carrier in response to an image formation request from a user and a predetermined developing bias is applied upon a toner carrier which rotates in a predetermined direction while carrying toner on a surface of said toner carrier, to thereby move said toner carried by said toner carrier to said image carrier, to visualize said electrostatic latent image with toner and to form a toner image,

characterized in that in the event that there is said image formation request newly received when an elapsed time since the end of formation of a toner image is equal to or longer than a sixth predetermined period,

before forming a toner image in response to said image formation request, idling of said toner carrier is executed which requires to rotate said toner carrier at least one round or more.

47. The image forming method of claim 46, characterized in that in the event that there is said image formation request newly received when said elapsed time is equal to or longer than a seventh predetermined period which is longer than said sixth predetermined period, before forming a toner image in response to said image formation request, said idling is executed and optimization is then executed which requires to form a toner image as a patch image, to detect a density of said patch image and to optimize a density control factor influencing an image density based on the result of the detection.